

Proceedings of AFLA 7

The Seventh Meeting of the Austronesian Formal
Linguistics Association

Edited by
Marian Klamer

Vrije Universiteit Amsterdam
Department of Linguistics
2000

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Preface

This volume consists of papers presented at the seventh meeting of AFLA (Austronesian Formal Linguistics Association), held at the Vrije Universiteit on May 11-13, 2000.

For the first time in the history of AFLA, this meeting was held outside the North-American continent, and contained contributions by speakers from eleven different countries: New Zealand, Australia, Indonesia, Brunei Darussalam, Taiwan, the USA including Hawaii, Canada, the UK, France, Germany, and The Netherlands.

Apart from the languages that are traditionally well-represented at Austronesian conferences, we were happy to see that the program also contained work on relatively small or lesser described languages, such as the minority languages of Taiwan, North-West Borneo, Eastern Indonesia, Papua and Oceania.

Special themes of this conference were Iconicity and Argument marking. The papers in this volume show that the program covered a broad range of subdisciplines -- from discourse grammar, phonology, morphology, syntax, to semantics -- and that the authors are working within various theoretical frameworks. But despite the obvious differences in expertise, interest and background, the atmosphere on the conference was typically AFLA: lively and constructive, with an average rate of attendance of about 80%. The papers in this volume deserve the same rate of attention.

This meeting has again furthered the unwritten mandate of AFLA to encourage the formal study of Austronesian languages, especially work by speaker linguists and junior scholars. Six scholars presented analyses of their native language, and more than half of the 45 participants subscribed as 'student'. This suggests that the future of Austronesian linguistics looks very bright indeed.

The eight edition of Afla will be held in the spring of 2001 at the Massachusetts Institute of Technology (MIT) in Boston, USA. The principal organiser will be Ileana Paul.

Marian Klamer, Vrije Universiteit Amsterdam

Proceedings of previous AFLA meetings:

A Selection of the papers of AFLA 2, in 1995 is published as:
Paul, Ileana, Vivianne Phillips, and Lisa Travis (eds.). 2000. *Formal Issues in Austronesian Linguistics*. Dordrecht, Kluwer.

The proceedings of AFLA 3 and AFLA 4 in 1996/1997 are published as:
Pearson, Mathew (ed.). 1998. *Recent papers in Austronesian Linguistics*. UCLA Working Papers in Linguistics 21.

The proceedings of AFLA 6 in 1999 are published as:
Smallwood, Carolyn and Catherine Kitto (eds.). 2000. *Proceedings of AFLA VI*. Toronto Working Papers in Linguistics.

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An Interpretation of the Voice Affix /i-/ in Tagalog

Anja Latrouite and Ralf Naumann
Seminar für Allgemeine Sprachwissenschaft
University of Düsseldorf
Germany

1 Introduction

In Tagalog, the main dialect spoken in the Philippines, at least five voice affixes (VA) can be distinguished: the two Actor voice (AV) affixes /um-/ and /mag-/, that are both prefixes, and the three Undergoer voice (UV) affixes /-in/ (UV₁), /i-/ (UV₂) and /-an/ (UV₃), the first and third of which are suffixes whereas /i-/ is a prefix.

Voice Affixes

ACTOR VOICE (AV)	UNDERGOER VOICE (UV)
/um-/, /mag-/	/-in/ (UV ₁), /i-/ (UV ₂), /-an/ (UV ₃)

A (verb-) stem *v* combines with a VA to build a complex predicate. This combination is subject to certain restrictions, i.e., not each VA is admissible for each stem. Furthermore, both the argument structure (AS) of a stem and its interpretation possibly depends on the VA with which it combines. These phenomena must be explained by any theory of the VAs in Tagalog.

2 The Data

2.1 Transfer-Verbs

According to Foley 1976, the VA /i-/ indicates a nominal which is an intermediary in the transfer of the main action of the clause between the two other nominals. This characterization applies to stems like /bigay/ ('give'), /turo/ ('teach') and /tanim/ ('plant'), elements of which will be said to belong to the 'bigay'-type in the sequel.

- | | | | | |
|----|--|-------------|-----------------|-------------------|
| a. | I-b-in-igay | ng babae | ang liham | sa kapit-bahay |
| | UV ₂ -b _{stem} -REALIS-give | NOM woman | GEN letter | DAT neighbour |
| | The woman gave the letter to the neighbour | | | |
| b. | I-t-in-uro | ng titser | ang Pilosopya | sa akin |
| | UV ₂ -t _{stem} -REALIS-teach | GEN teacher | NOM philosophy | I.DAT |
| | The teacher taught me philosophy | | | |
| c. | I-tanim | mo | sa hardin | ang mga bulaklak! |
| | UV ₂ -plant | you.GEN | DAT garden | NOM PL flower |
| | Plant the flowers in the garden! | | | |
| a. | B-in-igy-an | ng babae | ng liham | ang kapit-bahay |
| | B _{stem} -REALIS-give-UV ₃ | GEN woman | GEN letter | NOM neighbour |
| | The woman gave the neighbour a letter | | | |
| b. | T-in-uru-an | ako | ng titser | ng Pilosopya |
| | T _{stem} -REALIS-teach-UV ₃ | I.NOM | GEN teacher | GEN philosophy |
| | The teacher taught me philosophy | | | |
| c. | Tanim-an | mo | ng mga bulaklak | ang hardin! |
| | Plant-UV ₃ | you.GEN | GEN PL flower | NOM garden |
| | Plant the flowers in the garden! | | | |

For this type of stem only the UV affixes /i-/ and /-an/ are admissible. The UV /-in/ is excluded. There is no meaning variance (i.e., in the English translation the same verb is used) and the AS is the same for both UV affixes that are admissible.

Foley's characterization of /i-/ does not distinguish different *sorts* of transfer. In particular, it does not account for Pittman's (1966) observation that in Tagalog *centripetal* and *centrifugal* actions can be distinguished. Pittman applied this distinction to the interpretation of the AV affixes /um-/ and /mag-/.¹ But it can equally be used for an at least partial characterization of the UV affixes /i-/ and /-in/.

- the admissibility of /i-/ is related to *centripetal* action: /i-/ identifies the argument denoting the object *moving away* from the Actor as the subject of the clause
- the admissibility of /-in/ is related to *centrifugal* action: /-in/ identifies the object that is moved *towards* the Actor as the subject

An example for a stem that expresses a centrifugal action is /kuha/ ('take'). In contrast to elements of the 'bigay'-type, which express a centripetal action, /-in/ and /-an/ are admissible whereas /i-/ is excluded. The 'kuha'-type is similar to the 'bigay'-type in showing neither meaning variance nor changes of AS, depending on the VA with which a stem combines.

- (3) a. Kun-in mo sa kaniya ang lapis
 Take-UV₁ you.GEN he.DAT NOM pencil
 Get the pencil from him!
- b. Kun-an mo siya ng lapis
 Take-UV₃ you.GEN he.NOM GEN pencil
 Get a pencil from him!

¹ See Latrouite (1999) for extensive discussion.

This difference with respect to the admissibility is not accounted for by Foley's characterization, according to which the 'bigay'- and the 'kuha'-type should both admit /i-/ because there always is an intermediary (a transferred object).

2.2 Two Sorts of Transfer

In this section the two sorts of transfer, centripetal and centrifugal, will informally be defined. In the sequel the following convention is used: x = Actor; y = transferred object; z = destination/source of transfer (where it is required that $z \neq x$, i.e. z is not identical to the Actor). Let Q be the property such that $s \in Q(a)(b)$ just in case a has b at s , where 'has' is to be understood in a broad sense that not only covers possession but also knowledge (a knows b) and location (a is in/at b).

For a centripetal transfer one gets the following three possibilities that are admissible ($\alpha(e)$ is the beginning and $\omega(e)$ the end of an event that brings about the transfer).

- | | $\alpha(e)$ | $\omega(e)$ | |
|-------|------------------|------------------|-----------------------------|
| (i) | $\in Q(x)(y)$ | $\notin Q(x)(y)$ | /bigay/ (physical movement) |
| (ii) | $\in Q(x)(y)$ | $\in Q(x)(y)$ | /turo/ |
| (iii) | $\notin Q(x)(y)$ | $\notin Q(x)(y)$ | /tanim/ |

Cases (ii) and (iii) do not involve any change between x and y because the condition is an invariant. E.g., if x teaches z Philosophy, then x knows Philosophy at the beginning of the event (otherwise x could not teach it). But x does not loose this knowledge in the sense that at the end of the event z knows Philosophy whereas x has lost his knowledge on that particular topic. Examples of case (iii) are events of type 'tanim' where the Actor does not have the flowers that he is going to plant in the garden at the beginning of the event but begins by taking them. Another way of executing events of this type are subsumed by case (i). The Actor already has the object to be planted at the beginning.

A centrifugal transfer is characterized by the remaining fourth possibility.

$$\alpha(e) \notin Q(x)(y) \quad \omega(e) \in Q(x)(y) \quad \text{'kuha'-type}$$

2.3 Further types of Stems admitting /i-/

Even if one distinguishes between two sorts of transfer, this does not capture all generalizations concerning /i-/. Consider the following data.²

- (i) there are stems that admit all three UV-affixes

/akyat/ (go up), /hagis/ (throw), /halo/ (mix)

²Many of these data are taken from Himmelmann 1987.

- (4) a. Akyat-in mo ang kanya-ng kuwarto
 Go-up-UV₁ you.GEN NOM he-LINKER room
 Go up (upstairs) to his room
- b. Akyat-an mo ang kaniya-ng kuwarto ng mga libro
 Go-up-UV₃ you.GEN NOM he-LINKER room GEN PL book
 Bring the books up (upstairs) to his room!
- c. I-akyat mo ang mga libro
 UV₂-bring up you.GEN NOM PL book
 Bring the books up(stairs)

For /akyat/ one gets both meaning variance and change of argument structure: /-in/ transitive; /i-/ , /-an/ ditransitive.

- (5) a. Hagis-in mo siya ng sapatos
 Throw-UV₁ you.GEN he.NOM GEN shoe
 Throw the shoe at him!
- b. Hagis-an mo ako ng sapatos
 Throw-UV₃ you.GEN I.NOM GEN shoe
 Throw a show to me/in front of me!
- c. I-hagis mo sa akin ang sapatos
 UV₂-throw you.GEN I.DAT NOM shoe
 Throw a show at me!

In contrast to /akyat/, /hagis/ shows neither meaning variance nor change of AS.

(iia) there are stems that, like /bigay/, admit only /i-/ and /-an/ but with MV and change of AS

- (6) a. Hiwalay-an mo ang iba-ng pasyente
 Leave-UV₃ you.GEN NOM other-LINKER patient
 Leave (you) the other patients
- b. I-hiwalay mo siya sa iba-ng pasyente
 UV₂-separate you.GEN he.NOM DAT other-LINKER patient
 Separate (isolate) him from the other patients!

(iib) there are stems that, like /bigay/, admit only /i-/ and /-an/ and for which there is neither meaning variance nor a change of AS but which do not express a transfer. An example is /bukas/ ('open')

- (7) a. I-bukas mo ang pinto
 UV₂-open you.GEN NOM door
 Open the door!
- b. Buks-an mo ang pinto
 UV₃-open you.GEN NOM door
 Open the door!

- (iii) there are stems that admit only /i-/ but neither /-in/ nor /-an/: /bagsak/ ('drop/slam down'), /ikot/ ('turn'), /tungo/ ('bend') and /takbo/ ('run', 'take s.th. on the run')

- (8) a. B-um-agsak ang baso
 B_{stem} -AV/REALIS-drop NOM vase
 The vase fell/dropped
- b. I-b-in-agsak ng bata ang baso
 UV_2 - b_{stem} -REALIS-drop GEN child NOM vase
 The child slammed down the vase
- (9) a. T-um-akbo ako
 T_{stem} -AV-run I.NOM
 I run
- b. I-takbo mo ang gamot
 UV_2 -run you.GEN NOM medicine
 Run (away) with the medicine

These stems show both meaning variance and change of AS between AV- and UV-affix: with /um-/ they are intransitive, whereas with /i-/ they are transitive. Similarly to the 'bukas'-type, no third argument is realized such that there is no object that is transferred to a destination different from the Actor.

- (iv) there are stems for which /-in/ and /i-/ are admissible but not /-an/ and which show neither meaning variance nor change of AS. Examples are /saksak/ ('stab') and Point-verbs like /puknok/ ('hit') and /hampas/ ('hit', 'beat')

- (10) a. Saksak-in mo siya
 Stab- UV_1 you.GEN he.NOM
 Stab him!
- b. I-s-in-aksak ko sa kaniya ang lanseta
 UV_2 - s_{stem} -REALIS-stab I.GEN he.DAT NOM folding knife
 I stabbed him with a folding knife

- (v) there are verbs that allow all three UG affixes, yet for which /i-/ is admissible only if the subject denotes the instrument with which the action is executed.

- (11) I-kain mo ng isda ang iyong kutsara
 UV_2 -eat you.GEN GEN fish NOM-this-spoon
 Eat the fish with the spoon

The stems belonging to either (i), (iia) and (iv) can be interpreted as expressing a centripetal transfer if they combine with /i-/. This is shown in (12) by relating the stems to the three cases characterizing a centripetal transfer and in (13) for the specific examples given above.

- (12) a. /hagis/: the Actor has the transferred object at the beginning of the event but not at its end. This corresponds to the first case of a centripetal transfer

- b. /akyat/, /saksak/: they are covered by case (ii) of a centripetal transfer. The Actor has the transferred object continuously from the beginning until the end of the event
 - c. /halo/, /hiwalay/: these two stems belong to the third case of a centripetal transfer. The Actor has the transferred object *y* neither at the beginning nor at the end of the event (i.e., (s)he does not give away *y* to some destination).
- (13)
- a. /hagis/: the object thrown is transferred from the Actor to the place (or person) to (at) which it is thrown (or the destination is left implicit)
 - b. /akyat/: the books are transferred to the destination (i.e. the room)
 - c. /saksak/: the object stabbed, e.g. a knife, is transferred from a place outside the body of person *z* into *z*'s body such that *z* functions as the destination
 - d. /halo/: the stuff is transferred from some source location to the stuff it is mixed in as destination
 - e. /hiwalay/: the patient who is separated from the others is transferred from the latter to some destination that is left implicit

This interpretation is possible because the stem is always used ditransitively. From this it does not follow that whenever a stem is used ditransitively if it combines with /i-/ it expresses a centripetal transfer. Counterexamples to this generalization are stems like /kain/, listed in (v), where the third argument is the instrument that is used to carry out the action.

The stems discussed in (12) and (13) become problematic if one considers the admissibility with other UV-affixes and the possible changes both at the level of meaning and at the level of argument structure. E.g., if it combines with /-in/, the stem /akyat/ no longer expresses a transfer because it is used transitively and not ditransitively. This shows that admissibility with respect to this voice affix cannot be defined in terms of a centripetal action. They therefore constitute the same type of counterevidence as the stems in (iib) and (iii). The importance of these counterexamples can be taken to consist in showing that whenever a stem *v* expresses a transfer only for certain stems that are admissible for it but not for all, the (dynamic) meaning of *v* cannot be reduced to some sort of transfer but must be taken as something more general that subsumes a transfer as a special case. Such a generalization seems exactly what is needed in order to solve the problem that pose stems admitting /i-/ that do not express a transfer because they are used transitively.

The conclusion that must be drawn from the above discussion is that the notion of a centripetal transfer does not capture all uses of /i-/, if the notion of transfer is understood as involving three objects: a source, a destination and a transferred object. Counterexamples to this conception are stems discussed in (iib), (iii) and (v). In (14) the behaviour of /i-/ is summarized.

- (14) The UV-affix /i-/ is admissible for a stem *v* if one of the following conditions is satisfied.
- (i) an object *y* is transferred to some destination (location) that is not the Actor ('bigay'-type, centripetal transfer); in this case the stem *v* is used ditransitively; the subject determined by /i-/ is the transferred object

- (ii) the stem does not express a transfer
two subcases must be distinguished
- the action inherently involves an instrument (/kain/); the stem *v* is again used ditransitively; the subject determined is the instrument
 - stems covered by (iib) and (iii); only in this case the stem *v* is used transitively; the subject is the non-Actor argument

What is needed is a generalization of the notion of a centripetal Transfer that also captures cases (14iia) and (14iib).

3 Dynamic Event Semantics (DES)

3.1 Changes as Objects and Changes as Transformations of States

Dynamic Event Semantics (DES), Naumann 1998, to appear, is based on the intuition that non-stative verbs express changes. The intuitive notion of a change can be made precise in two different ways. It is either (i) an object (action, event), or (ii) a transformation of state, i.e., a state *s* at which a result *Q* does not hold is transformed into a state *s'* at which *Q* holds. Two aspects of a transformation of state can be distinguished: (a) a result *Q* that is brought about and (b) the way the result *Q* is brought about. This idea is made precise in DES by having both an *eventuality-structure* **E** and a *transition-structure* **S**.

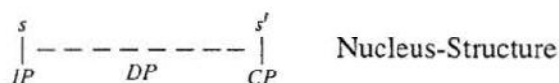
A basic eventuality-structure **E** is a tuple $\langle E, \sqsubseteq_E, \{P_v \mid v \in VERB\} \rangle$ such that

- E* is the domain of events
- \sqsubseteq_E is the material part of relation on *E*
- each *P_v* is a subset of *e*; *P_v* is the set of all events of type *P_v*; e.g., for *v* = *eat*, *P_v* is the set of all eating events

A basic transition-structure **S** is a tuple $\langle S, <_S \rangle$ such that

- S* is the domain of states (or time points)
- $<_S$ is the precedence (earlier) relation on *S*

The two structures are related by two total functions $\alpha : E \rightarrow S$ and $\omega : E \rightarrow S$ that assign to each event *e* ∈ *E* its beginning- and end point, respectively. Together, α and ω determine *e*'s execution sequence $\tau(e) = \{s \in S \mid \alpha(e) \leq_S s \leq_S \omega(e)\}$. This sequence can be split into three parts corresponding to a nucleus-structure (Moens/Steedman (1988)). There is the inception-point (IP), the development-portion (DP) and the culmination-point (CP) ($\alpha(e) = s$, $\omega(e) = s'$).



IP (inception-point) = [*s*], *DP* (development-portion) =]*s*, *s'*], *CP* (culmination-point) = [*s'*]

3.2 Types of Results

Each event-type P_v determines for each of its elements e a set $Res(P_v, e)$ of results that e can possibly bring about. Two principle types of results are distinguished: minimal and maximal ones. They are informally defined in (15) (For a formal definition, see Naumann/Latrouite 1999 and Latrouite/Naumann 1999b).

- (15) a. *minimal* results possibly hold at intermediate states of the execution sequence of an event
b. *maximal* results only hold at the end point of an event (if they hold there at all)

The two types of results are illustrated by an event of type 'John eat a fish'. Minimal results are: (i) partial decrease of the mass of the fish and (ii) part of the mass of the fish is in John's stomach. Results which are maximal are: (i) the mass of the fish is zero (complete decrease of its mass) and (ii) the (complete) mass of the fish is in John's stomach. Minimal and maximal results together are the v -closed results. Intuitively, a result is v -closed if bringing it about on an initial stage e' of an event e that belongs to P_v is sufficient for e' to belong to P_v too.

The types of results are temporally ordered by \leq_v : if $Q \leq_v Q'$, this means that whenever Q' is brought about on the execution sequence of an event $e \in P_v$, then Q has already been brought about, i.e., Q is brought about not later than Q' . Results that are distinct but which are brought about simultaneously, can be distinguished by implicational relations; this yields the more fine grained ordering \leq_v^* : $Q \leq_v^* Q'$ just in case $Q <_v Q'$ or $[Q =_v Q' \wedge Q' \subseteq Q]$.

3.3 Sorts of Event-Types

Minimal and maximal results do not exclude each other. The exact relationship depends on the *sort* of event-type to which P_v belongs. Two basic sorts are distinguished:

- (16) a. P-atomic event-types

$$\forall P[P - ATOMIC(P) \longleftrightarrow \forall e[e \in P \rightarrow \neg \exists e'[prefix(e', e) \wedge e' \in P]]]$$

an event-type P is P-atomic just in case for each of its elements e no proper initial stage (prefix) e' belongs to P

- b. non-atomic event-types

$$\forall P[NON - ATOMIC(P) \longleftrightarrow \neg P - ATOMIC(P) \wedge \forall e[e \in P \rightarrow \alpha(e) <_s \omega(e)]]$$

an event-type P is non-atomic just in case none of its elements is point-like and there is at least one element which has a proper initial stage e' that is of type P too

Examples for P-atomic event-types are those corresponding to the stems /kuha/ and /bi-gay/. Non-atomic event-types are those corresponding to stems of sort Accomplishment like /kain/, /kanta/ ('sing') and /bukas/.

For P-atomic event-types, the distinction between minimal and maximal results collapses. Each minimal result is maximal and vice versa. For non-atomic event-types minimal results are never maximal. These possibilities lead to the following definitions of further types of results in terms of the two basic ones.

- (17) a. A result Q is *w-maximal* just in case it is both minimal and maximal
 b. A result Q is *s-maximal* just in case it is maximal but not minimal
 c. A result Q is *w-minimal* just in case it is minimal but not maximal

From what has been said it follows that P-atomic event-types determine only w-maximal results, whereas Non-atomic event-types (corresponding to non-stative stems) determine either only w-minimal results or w-minimal and s-maximal results. In Table 1 the types of results for three classes together with the ordering in terms of \leq_v^* are depicted.

Table 1	types of results determined
ACCO	w-min \leq_v^* (\leq_v) s-max
ACT	w-min
/kuha/, /bigay/	w-max (2); w-max ₁ \leq_v^* w-max ₂

Table 2 illustrates the assignment of results to different arguments whereas Table 3 gives examples of different types of results for various stems together with the assignment to arguments (Results that are $\text{minimal}_{\text{non-v}}$ are brought about before w-minimal results and are not v-closed, i.e., bringing about only results of this type is not sufficient for an event to be of type v).

Table 2		x	y	
ACCO	/kain/	w-min; s-max ₂	w-min s-max ₁ ; s-max ₂	-
Transfer		x	y	z
sort	/kuha/	w-max ₂	w-max ₁ w-max ₂	w-max ₁
sort	/bigay/	w-max ₁	w-max ₁ w-max ₂	w-max ₂

Table 3	$\text{min}_{\text{non-v}}$	w-min.	w-max. or s-max.
eat an y	initial	partial decrease of y	mass of y = 0 (s-max ₁) mass of y is in x's stomach (s-max ₂)
push y	actions	y traverses a path	-
x takes y from z	performed		x has y (w-max ₂) z does not have y (w-max ₁)
x gives y z (involving physical action)	by the Actor	-	z has y (w-max ₂) x does not have y (w-max ₁)

4 Generalizing the Notion of Transfer

From the perspective of DES a transfer, either a centripetal or a centrifugal one, is an event e that brings about a number of results that are determined by the event-type P_v to which e belongs. E.g., for an event e of type 'bigay' the two principle (v -closed) results are that the Actor x ceases to have the Transferred Object y whereas the Destination z starts to have y at the end of the event (see Table 3). Both results are of type w -maximal and are therefore maximal. As these results are required to hold at the end point $\omega(e)$ of e , it follows that they only hold at that point of e 's execution sequence $\tau(e)$ and at no other point. This means that these results are brought about last. They are therefore maximal elements of $Res(P_v, e)$ relative to the ordering \leq_v . Results which satisfy this condition will be called *strongest* results. The exact definition is given in (18) (Q a set of results).³

$$(18) \forall Q \forall Q' (\text{Strongest}_v(Q, Q') \Leftrightarrow Q \in Q \wedge \forall Q' (Q' \in Q \rightarrow Q' \leq_v Q))$$

Maximal results are always strongest results. The inverse need not be true. E.g., an Activity-verb like 'push' in English or the stem /asin/ ('salt') in Tagalog determine only (w -) minimal but no maximal results. Consequently, the strongest results of $Res(P_v, e)$ for $v = \text{push}$ are (w -) minimal and not maximal.

Strongest results are maximal with respect to \leq_v . Similarly, *greatest* results are maximal elements of $Res(P_v, e)$ relative to the more fine-grained ordering \leq_v^* .

- (19) a result Q is the *greatest* element of $Res(P_v, e)$ with respect to \leq_v^* just in case it is a maximal element of $Res(P_v, e)$ with respect to \leq_v^*

$$\forall Q \forall Q' (\text{Greatest}_v(Q, Q') \Leftrightarrow Q \in Q \wedge \forall Q' (Q' \in Q \rightarrow Q' \leq_v^* Q))$$

Greatest elements are in general unique. An exception is the stem /akyat/, which can define two greatest results. Furthermore, greatest elements are always strongest results. The inverse need not be true. This has to do with $=_v$ -equivalence: different results that are brought about simultaneously can all be strongest results but they can (possibly) be distinguished by \leq_v^* . An example is given by w -maximal results. One has: $w\text{-max}_1 \leq_v^* w\text{-max}_2$ and $w\text{-max}_1 =_v w\text{-max}_2$. Both w -maximal results are strongest results but only the $w\text{-max}_2$ result is a greatest element of $Res(P_v, e)$. In Table 4 the distinction between strongest and greatest results is illustrated by means of some examples.

³Note that according to (18) the definition of a strongest result is relativized to an event-type P_v because there is not a single relation *Strongest* but for each $v \in \text{VERB}$ there is a corresponding relation *Strongest* _{v} .

Table 4	strongest results	greatest results
/bigay/	z has y not (x has y)	z has y
/kuha/	x has y not (z has y)	x has y
/kain/	mass of y = 0 mass of y is in stomach of x	mass of y is in stomach of x
/hagis/	y is at z	y is at z
/akyat/	x/y is at z	x/y is at z
/saksak/	y is in z	y is in z

From Table 4 it follows that the characterizing result of a centripetal transfer, the Destination z has the Transferred Object y , is expressed in DES as a particular type of result, namely as the greatest element of $Res(P_v, e)$. Furthermore, the Transferred Object y is, in addition, assigned all v -closed results. E.g., in the case of an event e of type 'bigay' y is assigned both the w -maximal₁ result (' x does not have y ') and the w -maximal₂ result (' z has y '). When taken together, one gets (20).

- (20) a. The Destination z and the Transferred Object y are both assigned a greatest result from $Res(P_v, e)$
b. the Transferred Object y is assigned all v -closed results

The condition characterizing y in (20) does not rely on the fact that the greatest element(s) of $Res(P_v, e)$ is (are) also assigned to some other object z . Thus, (20) is an instance of the more general scheme in (21).

- (21) a. The object y is assigned a greatest result from $Res(P_v, e)$
b. The object y is assigned all v -closed results

(21) differs from (20) in not requiring that the greatest result(s) from $Res(P_v, e)$ be assigned to any other object besides y . According to (21), a transfer (-event) e is characterized by the fact that there is an object participating in e that is assigned all v -closed results and (therefore) a greatest element from $Res(P_v, e)$. This characterization not only applies to transfers, i.e., events involving a Source, a Destination and a Transferred Object, but also to the events denoted by the stems in (iib) and (iii) for which only two participants undergo a change. In Table 5 the v -closed results for the corresponding stems are given and in (22) the results are paraphrased in terms of a transformation of state.

Table 5	v closed results
/bukas/	y is open
/bagsak/	y is falling (down) $\rightarrow y$ traverses a non-empty path
/tungo/	y is in a bending state $\rightarrow y$ traverses a non-empty path
/ikot/	y is turning (rotating) $\rightarrow y$ traverses a non-empty path

- (22)
- a. /bukas/: the object y that is opened, e.g. a door, is transferred from its initial position, it is closed, to its final position, it is open, i.e., its angle to the wall is no longer zero degree
 - b. /bagsak/: the object y slammed down, e.g. a vase, is transferred from its initial position (say, standing at some place z') to its final position (say on the ground)
 - c. /tungo/: the object y is brought from a state in which it is straight into a bending state
 - d. /ikot/: the object y is brought from a state in which it is at rest into a state in which it is no longer at rest but in which, e.g., it is turning

The intuition behind the generalization in (21) is the following. If there is a destination z to which y is transferred during the event e , this is expressed as a result: z has (or possesses) y , which is the greatest result of $Res(P_v, e)$. If there is no destination, this is equally expressed in terms of a result: y is in state ϕ at the end of e . Thus, y can be said to be 'transferred' into a state ϕ in which it has not been at the beginning of the event, i.e., y is transferred in a non-literal sense.

The problem that the generalization in (21) faces is that it is too broad. E.g., it equally applies to stems of the 'kuha'-type. What is needed is a generalization of (20) that is more restricted than the generalization given in (21). (21) can be restricted in at least two ways. On the one hand, it is possible to impose restrictions on the *type* of result assigned to either y or all participants of e . On the other hand, there are restrictions on which objects, besides y , are assigned the greatest element(s). These options will be considered in the next section.

5 Admissibility Condition for /i-/

In the preceding section it was shown that if an object y is transferred to the destination z , then a greatest result is assigned to both y and z : $Q(z)(y)$ for $s \in Q(a)(b)$ just in case a has b at state (point) s . This assignment to y is independent of the sort of transfer, i.e. of whether the transfer is centripetal or centrifugal. Consequently, in a proper transfer the Transferred Object y is always assigned a greatest element from $Res(P_v, e)$: $Q(a)(y)$ for some a participating in e . For a centrifugal transfer, $a = x$ holds, i.e., a is the Actor, whereas for a centripetal transfer a is not identical to the Actor such that $a \neq x$ holds. Thus, the requirement in (23) is sufficient to exclude stems of the 'kuha'-type.

- (23) The Actor x is *not* assigned a greatest element from $Res(P_v, e)$

If (23) holds, i.e., if $a \neq x$, the two sorts of transfer characterized by $\omega(e) \notin Q(x)(y)$ are captured. Now, $\omega(e) \notin Q(x)(y)$ is an instance of the following general scheme.

- (24) for all d s.t. $Q(\dots, d, \dots)$ with $Q \in Res(P_v, e)$ and Q a greatest element: $d \neq x$

(24) requires that the Actor x be assigned no greatest result. This requirement applies not only to Transfer-verbs but to any verb because it imposes only a condition on the Actor x . Consequently, also cases in which there is no transfer and in which x is not assigned a greatest element are captured. This applies to stems like /bukas/, /ikot/ or /tungo/.

(23) restricts (21) because it simply adds a further condition that must be satisfied, besides those imposed by (21). It differs from (20) because no condition is imposed on a possible Destination z , but rather on the Actor x . As each event has an Actor x but not necessarily a Destination z , (23) is a generalization of (20).

(23) cannot be the final version of the admissibility condition for /i-/ because it is too restrictive. It excludes stems that admit this VA. Examples are the stems /akyat/, /kain/ and /takbo/. In each case the interpretation of the stem assigns for a given event $e \in P_v$ a greatest element to the Actor x . They are therefore similar to stems like /kuha/ although they differ with respect to the admissibility of /i-/.

Stems belonging to the 'kuha'-type can be distinguished from stems like /akyat/ as follows. There is a result Q' , namely the $w\text{-max}_1$ result, that is assigned to y but not x : z does not have y . As each w -maximal result is v -closed, it follows that there is a v -closed result that is assigned to y but not to x . The Actor x is the object that is assigned the greatest result besides the transferred object y which is assigned all v -closed results. Now consider the requirement in (25).

- (25) If the greatest result(s) Q is (are) assigned to some object x' besides the object y that is assigned all v -closed results, each v -closed result Q' that is assigned to y (and some other participant x'') is also assigned to x'

This condition is *not* satisfied for the 'kuha'-type, as shown above: y is assigned the $w\text{-max}_1$ -result but it is *not* assigned to x , although x is assigned the greatest element besides y . This condition *is* satisfied for the three stems that admit /i-/, although the Actor x is assigned the greatest element. In Table 6 the greatest element(s) together with the other v -closed results that are assigned to y and some other participant x' are shown.

Table 6	greatest element	non-greatest elements
/kain/	the mass of y is in the stomach of x	part of the mass of y is in the stomach of x
/akyat/	x/y are at z	x/y move up towards z
/takbo/	x and y move together (only v -closed result)	x and y move together

The first two stems semantically determine w -minimal and s -maximal results. The s -maximal result that is the greatest element is assigned not only to y but also to the Actor x (and the Goal z in the case of /akyat/). The same assignment of objects also holds for the w -minimal result that is assigned to more than one object so that condition (25) is satisfied. For /takbo/ the greatest element is of type w -minimal, i.e., no maximal results are determined. This result is assigned to both x and y , i.e., condition (25) is again satisfied.

The intuition behind (25) is that if the Actor x is assigned a greatest element, it is required that (s)he be involved with the object y that is assigned this result too for all initial stages e' of e that are of type v . The condition in (25) not only applies to Transfer-verbs but to all verbs because y is not required to be transferred in some sense but is singled out by the requirement that it be assigned all v -closed results.

When taken together, one arrives at the admissibility condition for /i-/ in (26).

(26) The UV_2 affix /i-/ is admissible for a stem v just in case either

- a. the Actor x is not assigned a greatest element from $Res(P_v, e)$ for $e \in P_v$, or
- b. the Actor x is assigned a greatest element Q from $Res(P_v, e)$ for $e \in P_v$ and for each $y \neq x$ that is assigned Q too all v -closed results assigned to y (and at least one other object x') are assigned to x too

6 Admissibility Condition for /-in/

If only stems belonging to the 'kuha'-type are considered, the admissibility condition in (27) could be used for the UV_1 affix /-in/.

(27) admissibility condition for /-in/ (1. version)

the VA /-in/ is admissible for a stem v just in case

- a. P_v determines for each of its elements a maximal result

$$\forall e(e \in P_v \rightarrow \exists Q(Q \in Res(P_v, e) \wedge \max_v(Q)))$$

- b. the Actor x of an event $e \in P_v$ is always assigned a greatest element of $Res(P_v, e)$

$$\forall e(e \in P_v \rightarrow \exists Q \exists d(Q \in Res(P_v, e) \wedge Greatest_v(Q, Res(P_v, e)) \wedge \Delta_v(e)(d)(Q) \wedge Actor(e) = d))$$

If P_v determines for each of its elements a maximal result, it follows that the greatest elements are maximal results. (27b) can therefore be strengthened to: 'the Actor x is always assigned a maximal result that is a greatest element of $Res(P_v, e)$ '.

The problem that the admissibility condition in (27) faces was already alluded to above. There are stems v that admit /-in/ but for which the Actor is not assigned a maximal result that is a greatest element of $Res(P_v, e)$. Three classes can be distinguished:

- (28) a. stems like /kanta/ ('sing'), /basa/ ('read'), /halo/ ('mix') and /saksak/ ('stab')
- b. Point-verbs like /hampas/ ('hit') and /puknok/ ('hit', 'beat')
- c. stems like /hagis/ ('throw')

Stems v belonging to the first class are characterized by the property that an event $e \in P_v$ is *materially incremental* with respect to at least one object that is assigned a greatest element from $Res(P_v, e)$. This property is formally defined in (29).

(29) an event $e \in P_v$ is *incremental* with respect to an object d participating in it just in case the following conditions hold ((e, e') $\in R_B$ just in case e is a proper initial stage (prefix) of e' ; \sqsubset_O is the (proper) material part relation on the domain O of objects; $\Delta_v^*(e)(d)$ is true just in case d participates in e)

- a. $\forall e, e', d[e \in P_v \wedge R_B(e', e) \wedge \Delta_v^*(e)(d) \rightarrow \exists d'[d' \sqsubset_O d \wedge \Delta_v^*(e')(d')]]$ and

$$b. \forall d, d', e [e \in P_v \wedge \Delta_v^*(e)(d) \wedge d' \sqsubset_O d \rightarrow \exists e' [R_B(e', e) \wedge \Delta_v^*(e')(d')]]$$

The second class is characterized by the property in (30).

- (30) The Destination z does not have (possess) the Transferred Object y at the end of the event; rather, y only touches z and produces a sound

Furthermore, the result does not continue to hold after the end of the event. In DES two sorts of results are distinguished: *event-related* and *state-related* results. A result Q is event-related just in case it does not continue to hold after the end of an event that brought it about. A result Q is state-related just in case it continues to hold after the end of an event that brought it about until another event undoes it (if there is such an event at all), (31).

$$(31) \forall Q \forall e [e \in P_v \wedge Q \in Res(P_v, e) \wedge Greatest_v(Q, Res(P_v, e)) \rightarrow Event-Related(Q)]$$

The characterizing property of verbs belonging to the third class, /hagis/, is given in (32).

- (32) The Actor is never active until the end of an event of this type

(32) implies that for all results Q that are determined by P_{hagis} for an event e belonging to this set and that are required to hold at the end point $\omega(e)$ of e one has that Q is not assigned to the Actor, (33).

$$(33) \forall Q \forall e [Q \in Res(P_v, e) \wedge \omega(e) \in Q \rightarrow \forall d (\Delta_v(e)(d)(Q) \rightarrow \neg Actor(e, d))]$$

The characterizing properties of the three classes must be accounted for in the admissibility condition of /-in/. Formally, this means that the second clause of the admissibility condition in (27) must be disjunctive. This yields (34) (the admissibility condition improves on that given in Latrouite/naumann 1999a/b).

- (34) admissibility condition for /-in/ (final version)

the VA /-in/ is admissible for a stem v just in case

- a. P_v determines for each of its elements a maximal result, and
 - either
 - bi. the Actor is always assigned a maximal result that is the greatest element with respect to $Res(P_v, e)$
 - or
 - bii. the Actor is never assigned a maximal result, and either (i) at least one object that is assigned a greatest element from $Res(P_v, e)$ is incremental (an Incremental Theme) or (ii) the Actor is never active until the end of the event

The first clause excludes activity-verbs like /asin/ ('salt') as well as stems like /takbo/ ('run', 'x takes y on the run'). Clauses bi and bii exclude stems like /bigay/, /bukas/, /ikot/, and /tungo/ because the Actor is never assigned the greatest element from $Res(P_v, e)$ and the participants that are assigned the greatest elements do not satisfy any of the conditions mentioned in bii; a stem like /hiwalay/ is excluded because the Actor x is not *always* assigned the greatest element (for ditransitive uses; for transitive uses, with meaning 'leave', x is assigned the greatest element) and the clauses of bii do not apply to it; a stem like /bagsak/ is excluded because it does not satisfy clause bi and neither of the conditions mentioned in bii; in particular, the third condition is excluded because for intransitive uses the Actor is involved until the end of the event.

7 The Determination of the Subject

7.1 The Subject determined by /i-/

Consider the set $S_{v,e}$ of participants of an event $e \in P_v$ that is determined by the following conditions.

(35) An object d is an element of the set $S_{v,e}$ just in case

- a. d is assigned a greatest result from $Res(P_v, e)$
- b. d is temporally minimal with respect to condition (a)
- c. d is not globally minimal

- (36) a. An object d participating in an event $e \in P_v$ is *temporally minimal* with respect to a condition Q relative to the participants of e just in case d satisfies Q and for each d' participating in e that satisfies Q too (i) d and d' are assigned the same results or (ii) the least result Q relative to the ordering \leq_v^* that is assigned to d \leq_v^* -precedes the least result relative to the ordering \leq_v^* assigned to d' or (iii) d and d' agree on the least result relative to \leq_v^* that is assigned to them and there is a least result Q that is assigned to d' but not to d
- b. An object d participating in an event $e \in P_v$ is *globally minimal* just in case (i) it is assigned the least result from $Res(P_v, e)$ relative to the ordering \leq_v and (ii) if there is an object d' participating in e that satisfies this condition too, then there is an antecedent event e' of e such that d is temporally minimal relative to d' with respect to condition (i) relative to e'

The first clause requires that d be assigned a greatest result from $Res(P_v, e)$. This condition need not single out a unique object participating in e , witness many of the examples that have been discussed so far. If, on the other hand, a unique participant is singled out, it is determined as the subject by /i-/. This is the case for stems like /bukas/, /baksak/, /ikot/ and /tungo/. In each case the object that satisfies clause (a) also satisfies clauses (b) and (c). Clause (b) is vacuously satisfied because only one object satisfies clause (a). Clause (c) is satisfied because the object that is assigned the greatest element is not the Actor, who is always globally minimal. Thus, if only those stems admitting /i-/ are considered for which the

greatest element(s) is (are) assigned to a unique object, the set $S_{v,e}$ can be taken to uniquely determine the subject that is determined by /i-/.

If the greatest element(s) is (are) not assigned to a unique object, two cases can be distinguished: either the Actor x is one of those objects or the Actor x is not among the objects that are assigned a greatest element. If the second possibility holds, i.e., if the Actor x is not assigned a greatest result, the stem expresses a centripetal transfer. This means that the greatest result is assigned both to the Transferred Object y and the Destination/Source z . This is the case for stems belonging to the 'bigay'-type, /hagis/, /halo/, /hiwalay/, /saksak/ and Point-verbs like /hampas/. The Destination/Source z is characterized by being assigned *only* the greatest element whereas the Transferred Object y is assigned further results which precede the greatest element. That means that the Transferred Object y is *temporally minimal* relative to z with respect to the condition of being assigned a greatest result. This condition is expressed in clause (ii), which, therefore, excludes the Destination/Source z . As the Transferred Object is in addition not the Actor, who is excluded by clause (iii), it follows that for this case too the set singles out a unique object that is determined as the subject by /i-/.

The last case to be considered is given by the condition that the greatest element of $Res(P_v, e)$ is assigned to more than one object, one of which is the Actor. This is satisfied for the stems /akyat/, /takbo/ and /kain/. For /akyat/ the Destination z is also assigned a w-minimal result (' x/y traversed a non-empty path towards z '). Yet, there is a further w-minimal result, ' x/y traversed a non-empty path', that is *not* assigned to z . As a consequence z , does not satisfy the minimality condition expressed in clause (ii). Contrary to the other cases, no single object is singled out so far because both the Actor x and the Transferred Object y satisfy the first two clauses. The Actor x is excluded by clause (iii) because the Actor is always globally minimal. Thus, for /akyat/ too $S_{akyat,e}$ determines a unique element that is denoted by the nominative argument if this stem combines with /i-/. The stem /takbo/ is similar to /akyat/ relative to the first two clauses. No unique participant d of e is singled out. The first two clauses determine the Actor x as well as the object y that is taken with by x . Similarly to the stem /akyat/ the third clause excludes x such that only y is an element of $S_{takbo,e}$, which is determined as subject by /i-/. For /kain/ the first condition yields both the Actor and the object eaten (the Incremental Theme). The minimality condition in (ii) excludes the latter (i.e. the Incremental Theme) so that only the Actor x is determined by the first two clauses. The latter is then excluded by clause (iii). As a consequence, for /kain/ $S_{kain,e}$ is the empty set, i.e., no object is singled out. Yet, for /kain/ neither the Actor nor the Incremental Theme is determined as subject by /i-/. This is exactly what is required.

From the above discussion it follows that for each stem admitting /i-/ that does *not* determine the instrument as subject the set $S_{v,e}$ is a singleton containing the object that is denoted by the nominative argument. Only for the stem /kain/ no object is determined, so that in this case the instrument is singled out as denotation of the nominative argument. When taken together, this yields the (37).

(37) The subject that is determined by /i-/ for a stem v is that participant d of an event $e \in P_v$ such that

- a. either d is the unique element of $S_{v,e}$

- b. or, if $S_{v,e}$ does not single out a unique participant of e , i.e., if $S_{v,e}$ is not a singleton, d is the instrument

7.2 The Subject determined by /-in/

If one considers only transfers of the sort expressed by stems of the 'kuha'-type, the subject determined by /-in/ is the Transferred Object y , similar to stems belonging to the 'bigay'-type when they combine with /i-/. The two VAs differ with respect to stems for which they are both admissible and for which they are used ditransitively. Examples are /hagis/, /saksak/ and Point-verbs like /puknok/. If they combine with /i-/, the subject is the Transferred Object y and not the Destination z . For the VA /-in/, the subject is the Destination z and not the Transferred Object y . The stem /akyat/ is similar to these three stems, although the argument structures differ (/in/: transitive; /i-/: ditransitive). Whereas for /-in/ it is the Goal that is determined as subject, it is the transferred object which is singled out by /i-/.

As was shown in the preceding section, the difference between the Transferred Object y and the Destination/Goal z consists in the number (or types) of results that are assigned to them. The Transferred Object y is always assigned all v -closed results whereas this is in general not the case for z . A v -closed result is not necessary a strongest result, witness w -minimal results that are v -closed but not strongest if the event-type also determines s -maximal results.

If one considers strongest results instead of v -closed ones, a Transferred Object is always assigned all strongest results, as Table 7 shows.

Table 7	strongest	assigned to	non-strongest
/kuha/			
transitive	x has y	x, y	
ditransitive	x has y $\neg(z$ has $y)$	$x, y (2), z$	
/hagis/	y is at z	y, z	y traversed a path
/saksak/	y is in z	y, z	y traversed a path
/puknok/	y is at/on z	y, z	y traversed a path

The 'kuha'-type differs from the other stems in the following respect. For /kuha/ y is either the unique object that is assigned *all* strongest results (ditransitive use) or it is temporally maximal with respect to this condition (transitive use). If the subject is determined by the condition that it (i) be assigned all strongest results and (ii) be temporally maximal with respect to this condition, this yields exactly the correct prediction.

If, on the other hand, this criterion is applied to the other stems in Table 7, it is the Destination z that is determined because y is assigned a further, non-strongest result: y traverses a non-empty path. But this is again what is required because z is singled out as subject by /-in/. The difference to the case of /kuha/ is the following. There is only one strongest result and it is assigned to the Transferred Object y and the Destination z , and not to the Actor x , as in the case of /kuha/ (transitive use). Therefore, the maximality condition singles out z and not y because y is assigned a non-strongest result that is not assigned to z .

For other stems admitting /-in/ the above criterion can be used too.

Table 8	strongest	assigned to	non-strongest
/akyat/	x is at y	x, y	x traversed a non-empty path
/kain/	the mass of y is in x's stomach the mass of y = 0	x, y (2)	part of the mass of y is in the stomach of x partial decrease of y's mass

Table 8 illustrates this for the stems /akyat/ and /kain/. For the former, x and y are both assigned all strongest results but x is temporally minimal because it is assigned a result that does not hold for y such that y is temporally maximal. A similar argument holds for stems like /sunod/ ('obey' if it combines with /-in/). For /kain/, y is already uniquely determined by the first condition because it is assigned both strongest results whereas x is assigned only one. An analogous argument applies to Achievement-verbs like /patay/ ('kill') and stems like /halo/ ('stir' if it combines with /-in/) and /kanta/ ('sing'). Thus, the above condition can be taken as the criterion which determines the subject for /-in/. It is repeated in (38).

- (38) The subject that is determined by /-in/ for a stem v is that participant d of an event $e \in P_v$ such that
- d is assigned all strongest results from $Res(P_v, e)$
 - d is temporally maximal with respect to condition (a)

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